B ® **BROCADE**

Brocade Fabric Watch™

User's Guide

Version 3.0

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Preface

Fabric Watch is an optionally licensed product, and requires a valid license key to function. It is supported on the SilkWorm® 3800 series of switches running Brocades Fabric OS™ v3.0.

About This Guide

This guide provides the following information about Fabric Watch:

Chapter 1 Introducing Fabric Watch	Provides an overview of Fabric Watch.
Chapter 2 Installing Fabric Watch	Provides instructions for installing Fabric Watch.
Chapter 3 Using Fabric Watch	Provides information about configuring and using Fabric Watch.

Related Publications

Related product information can be found in the following Brocade publications:

- Brocade Fabric OS Procedures Guide

- Brocade Fabric OS Reference

- Brocade MIB Reference

- Brocade Web Tools User's Guide

- Brocade Zoning User's Guide

- Brocade QuickLoop User's Guide

- Brocade Fabric Watch User's Guide

- Brocade Distributed Fabrics User's Guide

- Brocade ISL Trunking User's Guide

- Brocade Advanced Performance Monitor User's Guide

- Brocade SES User's Guide

Information about fibre channel standards and fibre channel in general can be found on the Fibre Channel Association web site, located at:

http://www.fibrechannel.com

Getting Help

Contact your switch supplier for technical support. This includes hardware and software support, all product repairs, and ordering of spare components.

Be prepared to provide the following information to support personnel:

- Switch serial number
- Switch worldwide name
- Topology configuration
- Output from the **supportShow** telnet command
- Detailed description of the problem
- Troubleshooting steps already performed

Getting Software Updates

Contact your switch supplier for software updates and maintenance releases. New switch firmware can be installed from the following host operating systems:

- UNIX
- Windows NT
- Windows 98
- Windows 95

Utility programs to facilitate loading firmware, sample Fabric Watch configurations, and MIB files for switch management by SNMP can be accessed on the Brocade website through the following steps:

1. Open a web browser at:
    http://www.brocade.com

2. Click **Support**.

3. Click **MIBs and RSH Utilities**.

4. Click the link for the desired product.

Introducing Brocade Fabric Watch

This chapter provides the following information:

*   *Overview* on page 1-1
*   *Threshold Behavior Models* on page 1-2

Overview

Brocade Brocade Fabric Watch^TM is used by SAN managers to monitor key fabric and switch elements, making it easy to quickly identify and escalate potential problems. It monitors each element for out-of-boundary values or counters and provides notification when any exceed the defined boundaries. The SAN manager can configure which elements, such as error, status, and performance counters within a SilkWorm switch, are monitored.

Brocade Fabric Watch^TM is an optionally licensed product that runs on SilkWorm 2000 series switches and above with Brocades Fabric OS™ version v3.0. Brocade Fabric Watch^TM can be accessed through:

*   Brocade Web Tools
*   A telnet interface
*   A SNMP-based enterprise manager
*   By modifying and uploading the Brocade Fabric Watch^TM configuration file to the switch.

Brocade Fabric Watch^TM monitors the following elements:

*   Fabric events (such as topology reconfigurations, zone changes)
*   Switch environment (fans, power supplies, and temperature)
*   Ports (state changes, errors, and performance)
*   GBICs (for switches equipped with SMART GBICs.
    Example: the Finiasr SMART GBIC FTR-8519-3).

With Brocade Fabric Watch^TM installed, each switch continuously monitors error and performance counters against a set of defined ranges. This and other information specific to each monitored element is made available by Brocade Fabric Watch^TM for viewing and, in some cases, modification. This set of information about each element is called a *threshold*, and the upper and lower limits of the defined ranges are called *boundaries*.

If conditions break out of acceptable ranges, an *event* is considered to have occurred, and one or more of the following alarms (reporting mechanisms) are generated if configured for the relevant threshold:

*   SNMP trap

- Entry in the switch event log
- Locking of the port log to preserve the relevant information
- RAN (Remote Asynchronous Notification) Alert.

   Note: The RAN alert is only available if the optional Fabric Access license has been purchased and turned on.

- Email Alert

You can deploy Brocade Fabric Watch^{TM} as shipped, or download a customized configuration profile from the following website:

```
http://www.brocade.com/support/mibs_Rsh
```

Threshold Behavior Models

The behavior models for thresholds are:
- Range
- Rising/falling
- Change monitor

Range Threshold

A range threshold tracks whether a fabric element is within a specified range. It includes a minimum and maximum boundary for the area, with buffer zones to prevent repeated events due to oscillation of the value over a threshold boundary. If the value exceeds the low or high threshold boundary, an event is generated. Fabric Watch can also generate events while the value is outside the limits or when it re-enters the prescribed range.

Figure 1-1 shows a typical example of an error counter with a temperature range threshold.
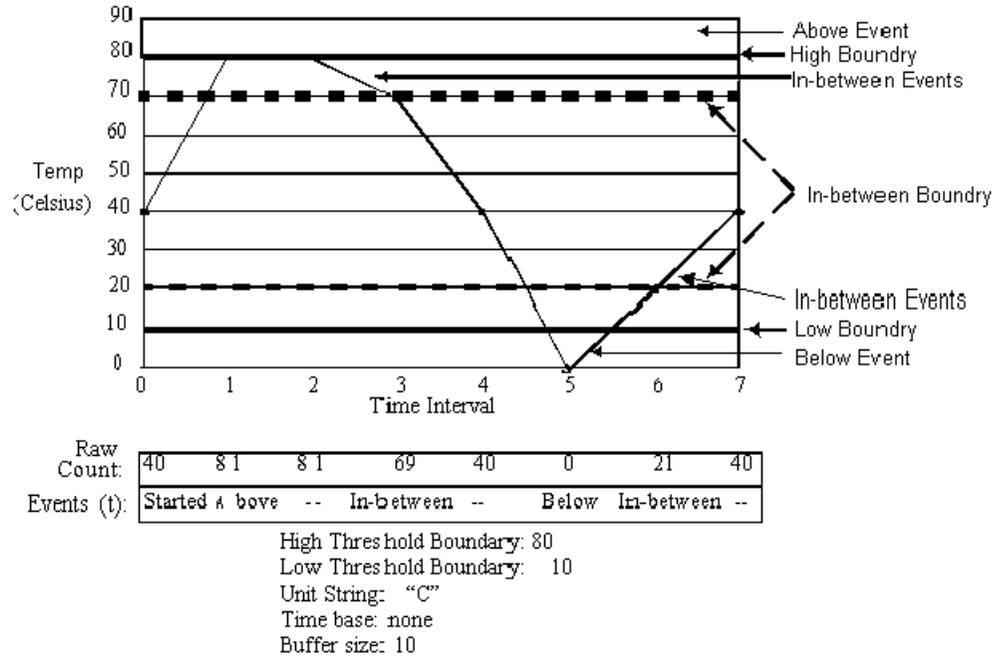
Figure 1-1   Example of Range Threshold: Temperature (Celsius)

Rising/Falling Threshold

A rising/falling threshold tracks whether an element is on the desired side of a boundary. It includes an upper and lower boundary, and the buffer zones are always zero. Events can be selected for transitions between the boundaries. Rising/falling thresholds are typically used for rate based counters. Rate based counters are all counters with a time base set to something other than "none", this includes the TX Perf and RX Perf counters.

Figure 1-2 shows a typical example of an error counter with a rising/falling threshold.
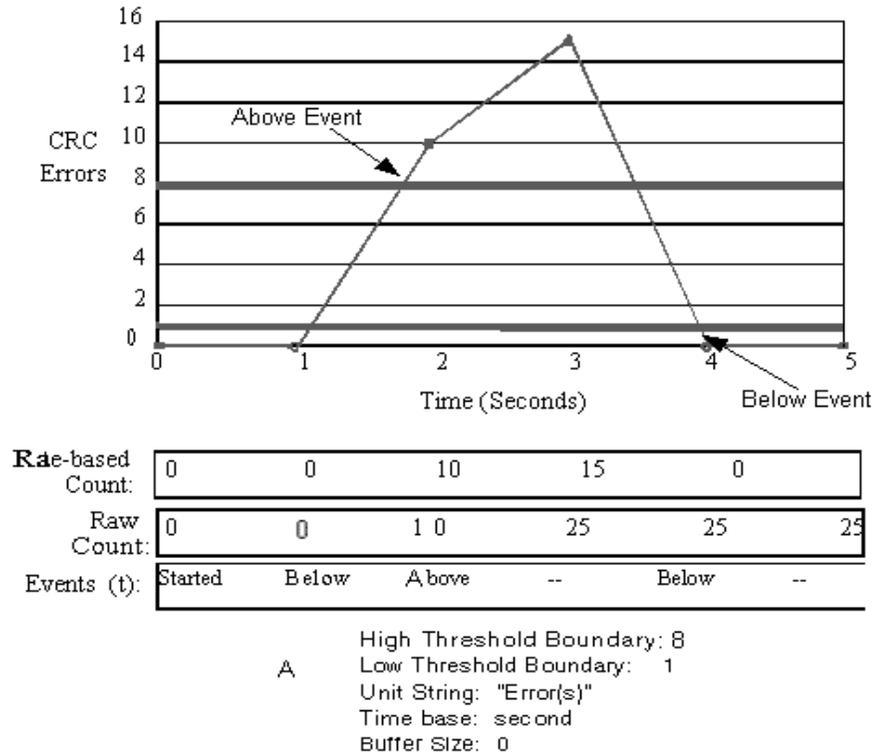
Figure 1-2   Example of Rising/Falling Threshold: Error Rate

Change Monitor Threshold

A change monitor threshold generates events whenever a counter value changes, regardless of the type of change. This type of threshold is usually used to indicate state changes, such as zoning changes.

Note: The change monitor counter value displayed is the cumulative count (historical count) and not the delta value from the previous triggered value.

An illustration is not provided because change monitor thresholds do not include boundaries.

Installing Fabric Watch

This chapter provides the following information:
- Installing through telenet commands 2-1
- Installing through Brocade Web Tools^{TM} 2-2

Each switch running Fabric Watch must have a Fabric Watch license installed on it. A license may have been installed in the switch at the factory. If not, contact your switch supplier to obtain a license key.

Fabric Watch requires a SilkWorm 2000 series switch or above running Brocade's Fabric OS^{TM} 3.0. A Fabric Watch license can be installed either using telnet commands or through Brocade Web Tools^{TM}.

Installing through Telnet

To install Fabric Watch using telnet commands perform the following steps:

1. Log onto the switch by telnet (refer to *Brocade Fabric OS User's Guide* for details), using an account that has administrative privileges.

2. To determine whether a Fabric Watch license is already installed on the switch, type **licenseShow** on the telnet command line.

    A list displays all the licenses currently installed on the switch.

    Example:

    ```
    admin> licenseShow

    1A1AaAaaaAAAA1a:
    Release v3.0
    Web license
    Zoning license
    SES license
    QuickLoop license
    ```

    If the Fabric Watch license is not included in the list or is incorrect, continue with step [3].

3. Enter the following on the command line:
    ```
    licenseAdd "key"
    ```
    where "**key**" is the license key provided to you, surrounded by double quotes. The license key is case sensitive and must be entered exactly as given.

4. Verify the license was added by entering the following on the command line:
    ```
    licenseShow
    ```
    If the license is not listed, repeat step [3].

Installing through Brocade Web Tools

To install Fabric Watch using Web Tools, perform the following steps:

1. Launch the web browser, enter the switch name or IP address in the **Location/Address** field (for example: `http://111.222.33.1`), and press Enter.

    Brocade Web Tools^{TM} launches, displaying the Fabric View.

2. Click the **Admin** button on the relevant switch panel.

    The logon window displays.

3. Enter a logon name and password with administrative privileges and press Enter.

    The Administration View displays.

4. Select the License Admin tab, enter the license key in the **License Key:** field, and click **Add License**.

Using Fabric Watch

This chapter provides the following information:

- *Overview* on page 3-1
- *User Interfaces* on page 3-1
- *Profiles* on page 3-2
- *Classes* on page 3-3
- *Threshold Naming Conventions* on page 3-7
- *Events* on page 3-8
- *Alarms* on page 3-9
- *Configuring Thresholds and Alarms* on page 3-10

Overview

Fabric Watch provides the following information about each out-of-boundary condition discovered:
- Name of threshold
- Current value of element counter
- Unit of measurement (for example, degrees Celsius, RPM, or unit of time)
- Time base for counter, used to compute rate of change (for example, events per minute)
- Historical information about the last alarmed event generated

User Interfaces

Use either Brocade Web Tools^{TM}, telnet interface, an SNMP-based enterprise manager, or the configuration file to view and modify Fabric Watch settings.

Brocade Web Tools

Through Brocade Web Tools^{TM}, you can:

- View fabric and switch events through the fabric-wide Event View.
- View and modify threshold and alarm configurations through the Fabric Watch View.
- Upload and download the configuration file through the Config Admin tab in the Switch Admin window.

Refer to the *Brocade Web Tools User's Guide* for information on using Brocade Web Tool^{TM}.

Telnet Interface

You can do the following using a telnet interface:

- Query fabric and switch events through the telnet command **fwShow**.

- Query and modify threshold and alarm configurations. Use the the telnet command **fwConfigure** to view the default and customized settings.

- Upload and download the configuration file through the commands **configUpload** and **configDownload**.

SNMP-Based Enterprise Managers

The Fabric Watch configuration information is stored as MIB variables, allowing you to do the following:

- Query the MIB variable for individual fabric and switch elements.

- Query and modify threshold and alarm configurations.

- Receive generated SNMP traps when threshold conditions are met.

Configuration File

You can view and modify the threshold and alarm configurations by uploading the configuration file from the switch to the host, editing it in a text editor, then downloading the modified file back to the switch. You can then ensure a uniform configuration throughout the fabric by distributing the configuration file to all the switches in the fabric.

The configuration file can be uploaded and downloaded through either Brocade Web Tools^{TM} (the Config Admin tab in the Switch Admin window) or the telnet commands **configUpload** and **configDownload**. After downloading the file back to the switch, you must either reboot the switch or use the telnet command **fwConfigReload** to reload the configuration file.

Profiles

Each Fabric Watch profile contains a unique threshold and alarm settings. Current profiles are divided into:

- debug
- workgroup errlog
- workgroup snmp
- enterprise errlog
- enterprise snmp

In addition, a Fabric Watch profile specific to your environment can be downloaded to the switch to customize the configuration.

Several customized profiles for Fabric Watch are available at the following website:

```
http://www.brocade.com/support/mibs_rsh/index.jhtml
```

Each profile is for a different purpose, and contains only the configuration information that is different from the default configuration.

The intention is to have distinct configuration setting for enterprise SAN and a workgroup SAN's are left for individual user's.

The default information is always preserved. After loading the profile, you can specify whether the default or the profile information is used.

A profile may contain the following information:
- Threshold values:
  - Unit string
  - Time base
  - Lower boundary
  - Upper boundary
  - Buffer size
- Alarm values
  - Change
  - Exceed
  - Below
  - Above
  - In-between
  - Behavior type

Classes

Fabric and switch elements are organized into **classes** (also known as Agents), which are groupings of closely related elements. There major classes are:

Fabric	Monitors key fabric resources, such as fabric reconfiguration, zoning changes, new fabric logins
Environmental	Monitors switch environment functions, such as temperature, power supply, fan status
Port	Monitors port error and performance counters
E_Port	Monitors E_Port error and performance counters
F/FL_Port (Optical)	Monitors optical FL/F_Port error and performance counters
F/FL_Port (Copper)	Monitors copper FL/F_Port error and performance counters
GBIC	Monitors operational values for FINISAR smart GBICs
ALPA	

> **Note:** The ALPA class is only available if the optional Performance Monitoring license has been purchased and turned on.

Monitors ALPA devices of Loop ports (currently CRC error of ALPA device only).

End-to-End

1 -   Monitors transmitting performance predefined by the SID-DID pair. Configurable with either telnet commands or Web Tools at run time.

2 -   Monitors receiving performance predefined by the SID-DID pair. Configurable with either telnet commands or Web Tools at run time.

3 -   Monitors CRC errors of prefedined SID-DID pair. Configurable with either telnet commands or Web Tools at run time.

The configuration information of the End-to-End class is lost when the switch is rebooted or fast booted.

Note: The End-to-End class is only available if the optional Performance Monitoring license has been purchased and turned on.

Note: The EE filter is preconfigured with either a telnet command or Web Tools at run time.

Filter

Monitors the filter counter for a given port. Provides the following types of information about the filter hit:

1 - Read command

2 - SCSI or IP traffic

3 - SCSI Read/Write

Note: The Filter class is only available if the optional Performance Monitoring license has been purchased and turned on.

Note: The type of filter is predefined by configuring it with either a telnet command or Web Tools at run time.

In addition, each class is subdivided into areas, as listed in the following table.

Table 3-1   Fabric Watch Classes and Areas

Class	Area	Description
Fabric	Loss of E_Port	Monitors E_Port status.
	Fabric reconfiguration	Monitors fabric configuration changes.
	Segmentation changes	Monitors segmentation changes.
	Domain ID changes	Monitors forcible DOMAIN ID changes.

Class	Area	Description
Fabric **Continued**	Zoning changes	Monitors changes to currently enabled zoning configuration.
	Fabric to QuickLoop changes	Monitors ports to detect changes from fabric to QuickLoop or QuickLoop to fabric.
	Fabric logins	Monitors number of host device fabric logins (flogi).
	GBIC change	Monitors insertion/removal of GBIC.
Environmental	Temperature	Monitors switch temperature.
	Fan	Monitors operation of switch fans.
	Power supply	Monitors status of each power supply.
Port	Link failure count	Monitors link failure count for each port.
	Loss of synchronization count	Monitors port sync loss.
	Loss of signal count	Monitors port signal loss.
	Primitive sequence protocol error	Monitors port protocol errors.
	Invalid transmission word	Monitors port invalid words.
	Invalid CRC count	Monitors port CRC errors.
	Receive performance	Monitors port receive performance.
	Transmit performance	Monitors port transmit performance.
	State changes	Monitors port state changes.
E_Port	Link failure count	Monitors link failure of each E_port.
	Loss of synchronization count	Monitors E_port sync loss.
	Loss of signal count	Monitors E_port signal loss.
	Primitive sequence protocol error	Monitors E_port protocol errors.
	Invalid transmission word	Monitors E_port invalid words.
	Invalid CRC count	Monitors E_port CRC errors.
	Receive performance	Monitors E_port receive performance.
	Transmit performance	Monitors E_port transmit performance.
	State changes	Monitors E_port state changes.
F/FL_Port (Optical)	Link failure count	Monitors link failure of each optical F/FL_port.

Class	Area	Description
	Loss of synchronization count	Monitors optical F/FL_port sync loss.
	Loss of signal count	Monitors optical F/FL_port signal loss.
	Primitive sequence protocol error	Monitors optical F/FL_port protocol errors.
	Invalid transmission word	Monitors optical F/FL_port invalid words.
	Invalid CRC count	Monitors optical F/FL_port CRC errors.
	Receive performance	Monitors optical F/FL_port receive performance.
	Transmit performance	Monitors optical F/FL_port transmit performance.
	State changes	Monitors optical F/FL_port state changes.
F/FL_Port (Copper)	Link failure count	Monitors link failure of each copper F/FL_port.
	Loss of synchronization count	Monitors copper F/FL_port sync loss.
	Loss of signal count	Monitors copper F/FL_port signal loss.
	Primitive sequence protocol error	Monitors copper F/FL_port protocol errors.
	Invalid transmission word	Monitors copper F/FL_port invalid words.
	Invalid CRC count	Monitors copper F/FL_port CRC errors.
	Receive performance	Monitors copper F/FL_port receive performance.
	Transmit performance	Monitors copper F/FL-port transmit performance.
	State changes	Monitors copper F/FL_port state changes.
GBIC (FINISAR Smart GBIC)	Temperature	Monitors GBIC temperature.

Class	Area	Description
GBIC (FINISAR Smart GBIC) **Continued**	Receiver power	Monitors GBIC receiver power.
	Transmitter power	Monitors GBIC transmitter power.
	Current	Monitors GBIC current.
ALPA	CRC Counter	Monitors all active ALPA devices on loop ports.
End-to-End	CRC - Counter	Monitors CRC errors of a predefined SID-DID pair at a given port.
	Transmit performance	Monitors transmit performance of predefined SID-DID pair at a given port.
	Receive performance	Monitors receive performance of a predefined SID-DID pair at a given port.
Filter	Customer defined fibre channel word.	Monitors the filter counter for a given port. Provides the following types of information about the filter hit: 1 - Read command 2 - SCSI or IP traffic 3 - SCSI Read/Write

Threshold Naming Conventions

All threshold names consist of the following three items, with no separators:

• Abbreviation for the class name (alpha characters, lower case), as follows:

<u>Class</u>	<u>Abbreviation</u>
Fabric	fabric
Environment	env
Port	port
E_Port	eport
F/FL_Port (Optical)	fopport
F/FL_Port (Copper)	fcuport
GBIC	gbic
ALPA	alpa
End-to-End	ee
Filter	flt

- Abbreviation for the area name (alpha characters, title case). For example, "Temp" for the Temperature area.
- Index number for the number of the item within the series. Consists of three numbers, for example: 000 for the first port, 001 for the next, etc. Index numbers for the Fabric, Port, E_Port, F/FL_Port (Optical), F/FL_Port (Copper), and GBIC classes begin with 000, and index numbers for the Environment class begin with 001.

Example of a Threshold Name:
The threshold corresponding to the first thermometer in the switch is in the Environment class, Temperature area, and is therefore named **envTemp001**.

Events

An event is generated each time a boundary, as defined by the threshold, is crossed. Boundaries are not inclusive, so events are generated only when a boundary is exceeded, not when the monitored value has only reached them. If the event has an assigned alarm, an alarm is also generated. The alarm can be designated as an SNMP trap, an entry in the switch error log, locking of the port log, or a combination of these options.

When an item such as an E_Port, F/FL_Port (optical), F/FL_Port (copper), FINISAR Smart GBIC, fan, or power supply is removed, Fabric Watch may raise an event (such as a below event), then the threshold is hidden and disabled. When an item is added, the threshold is displayed and enabled, and Fabric Watch may raise an event.

Event policies control the generation of events, and can be configured for either triggered events or continuous events.

Triggered Events

A triggered event results in a single event when a boundary is exceeded. The event is not generated again until the threshold value has returned within the boundaries and then once again exceeded them. For example, if the switch temperature exceeds the upper boundary, a triggered event is generated at the point the boundary is crossed, but is not repeated while the temperature remains above the upper boundary.

The following events can be generated as triggered events:

Started	No alarm is generated.
Below	Counter is below the lower boundary. Must be preceded by a start, above, or in-between event.
Above	Counter is above the upper boundary. Must be preceded by a start, below, or in-between event.
Exceeded	Counter is below the lower boundary or above the upper boundary. Accompanies a below or above event.
Changed	Counter value has changed.
In-between	Counter falls below the upper boundary minus buffer, or rises above the lower boundary plus buffer. Must be preceded by an above or below event. If the buffer is set to zero, this event is suppressed.

Continuous Events

A continuous event results in an event at each time interval from when the boundary is initially exceeded until the threshold value has returned within the boundaries. For example, if port utilization is above the upper boundary, a new event is generated at each behavior interval until utilization falls below the upper boundary. The following events can be generated as continuous events:

Started	No alarm is generated.
Below	Counter is below the lower boundary.
Above	Counter is above the upper boundary.
Exceeded	Counter is below the lower boundary or above the upper boundary. Accompanies a below or above event.
Changed	Counter value has changed.

Alarms

Each event can generate one or more alarms. Fabric Watch supports the following types of alarms:
- SNMP trap
- Switch event log entry
- Locking of the port log
- RAN
- Email

SNMP Trap

The following information is forwarded to an SNMP management station:
- Name of the element
- Class, area, and index of the threshold
- Type of event generated
- Element value
- New state of element

Error Log Entry

The internal error log maintains a record of the event, up to a maximum of 64 entries. If configured to do so, error log entries are forwarded to the SYSLOGD facility.

Locking the Port Log

Locking the Port Log freezes the switch port log to retain detail information about a problem. It is typically used in conjunction with the error log entry.

RAN

RAJ sends alarm messages to the remote agent proxy server.

Note: The RAN alert is only available if the optional Fabric Access license has been purchased and turned on.

Email Alert

The Email Alert sends alarms to the corresponding email addresses at run time. The configured email address applies to all areas within a class. See fwMailCfg in the *Fabric OS Reference Guide*.

Note: This alert only works with firmware images that supports Web Tools.

Note: Whenever the switch is fastbooted or rebooted the Email alert is disabled. The Email Alert must be reset after the switch is fastbooted or rebooted.

Configuring Thresholds and Alarms

The configuration of thresholds and alarms can be divided into two categories: *threshold values* and *threshold area values*.

Note: Timebase changes to thresholds in Env and GBIC agents are disabled. Non-factory timebase settings in configuration files for both of these thresholds will not have any effect. The factory timebase will be used.

Threshold Values

Threshold values apply to the specific threshold. They are not stored in the configuration file, and return to the default values if the switch is rebooted. The following threshold values can be modified:

Status	Can be enabled or disabled. Enabled by default.
Behavior type	Allows setting of the event policy to triggered or continuous. Set to triggered by default.
Behavior interval	The interval between the same type of alarm. Applies only to continuous events. The default interval is 1 second.

Threshold Area Values

Threshold area values include boundaries and alarms, and apply to all the thresholds within an area. Changes are stored in the configuration file.

Boundaries

The following boundary information can be modified:

Unit string	Represents unit value. Only the default unit strings are supported by Fabric Watch.
Time base	Time period within which a specified event is measured. Can be from one second to one day. Shorter time periods are more sensitive to fluctuations and therefore will provide more detailed information.

> **Note:** The Time base boundary can only be modified through a telnet command. The Time base bounder does not apply to the:
> - Transmit performance area
> - Receive performance area
> - Filter class

Low boundary	Minimum value. An event is generated if the element value falls below this boundary.
High boundary	Maximum value. An event is generated if the element value rises above this boundary.
Buffer size	Size of buffer set up to decrease generation of in-between events due to oscillation of the element value over a boundary.

Alarms

The following alarms can be added or deleted:

ERRLOG	Logs errors to switch. If configured properly, sends message to syslog on daemon.
SNMP-TRAP	Sends trap to SNMP agent.
PORT-LOG-LOCK	Freezes port log to preserve log information generated at time of event, for diagnostic purposes.
RAN	Sends alarm messages to remote agent.

> **Note:** The RAN alert is only available if the optional Fabric Access license has been purchased and turned on.

Email Alert	Sends alarm messages to the corresponding mail address.

Example Error Message

This appendix provides an example Errlog message.

Overview

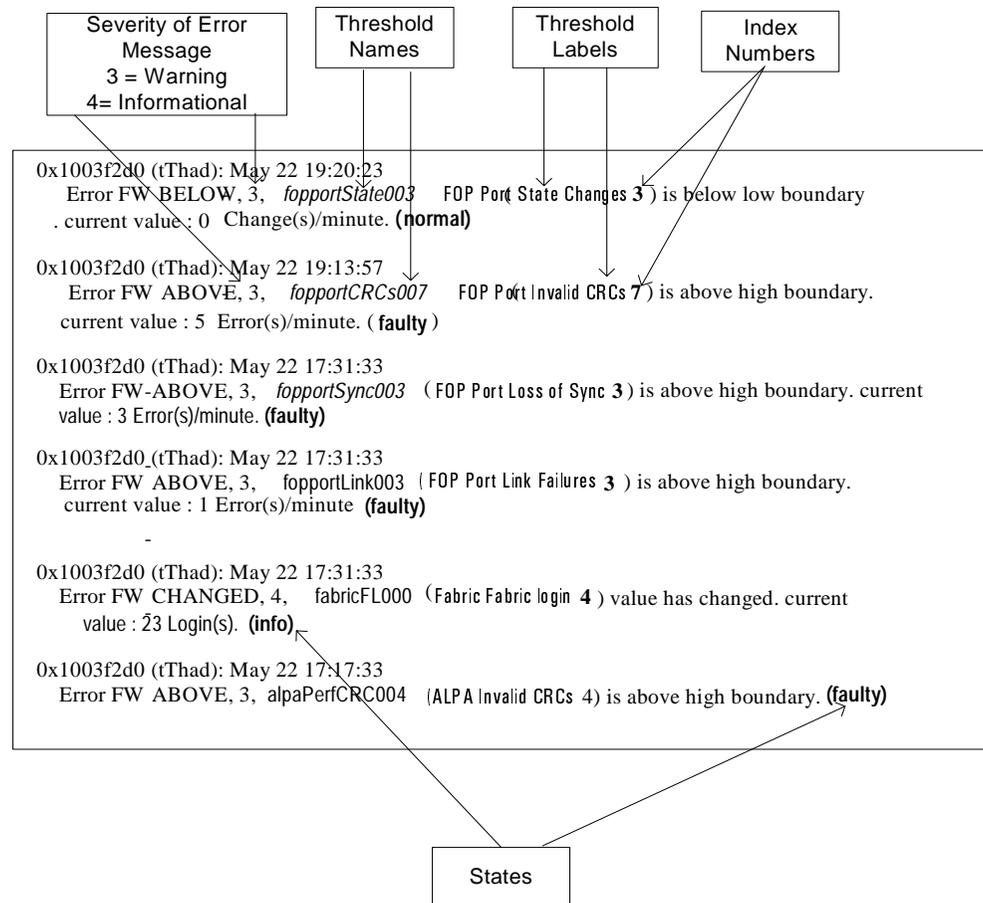Figure A-1 shows a typical Fabric Watch Errlog message.

Figure A-1 Typical Fabric Watch Errlog Message

Note: Threshold name = class name + area name + element index.
Example: FopportLink003, fabricFL000, alpaPerfCRC004

Example 1:

class name = **env,**

area name **= Fan,**

element index = **000-002**

threshold name is **envFan000 – envFan002**

Example 2:

class name = **gbic**,

area name = **Temp**

element index = **001-00x**

threshold name is gbicTemp001-gbicTemp00x

Table A-1   Fabric Watch Threshold Class / Area Abbreviation Table

Class name: class abbreviation	Area name: area abbreviation
Environment: **env**	Power supply: **PS**
	Temperature (sensor): **Temp**
	Fan speed sensor: **Fan**
Gigabit Interface Converter: **gbic**	Temperature (sensor): **Temp**
	Receiver power: **RXP**
	Transmitter power: **TXP**
	Current: **Crnt**

Expansion port: **eport**	Invalid CRCs: **CRCs**
Port: **port**	Link Failures: **Link**
Fabric copper port: **fcuport**	Protocol Errors: **ProtoErr**
Fabric optical port: **fopport**	RX Performance: **RXPerf**
	Loss of Signal: **Signal**
	State Changes: **State**
	Loss of Sync: **Sync**
	TX Performance: **TXPerf**
	Invalid Words: **Words**
Fabric**: fabric**	Domain ID: **DI**
	E-port down: **ED**
	Fabric login: **FL**
	Fabric<->QL: **FQ**
	Reconfigure: **FR**
	GBIC change: **GS**
	Segmentation: **SC**
	Zoning change: **ZC**
	Name server login: **NL**
	Name server request: **NR**
Performance alpa monitor: **alpa**	Invalid CRCs: **PerfCRC**
Performance end to end monitor: **EE**	Invalid CRCs: **PerfCRC**
	TX Performance: **PerfTX**
	RX Performance: **PerfRX**
Performance filter monitor: **filter**	Filter frame counter: **PerfPT**

A Example Error Message

Glossary

8b/10b Encoding	An encoding scheme that converts each 8-bit byte into 10 bits. Used to balance ones and zeros in high-speed transports.
Address Identifier	A 24-bit or 8-bit value used to identify the source or destination of a frame.
AL_PA	Arbitrated Loop Physical Address; a unique 8-bit value assigned during loop initialization to a port in an arbitrated loop.
Alias Address Identifier	An address identifier recognized by a port in addition to its standard identifier. An alias address identifier may be shared by multiple ports.
Alias AL_PA	An AL_PA value recognized by an L_Port in addition to the AL_PA assigned to the port. See also *AL_PA*.
Alias Server	A fabric software facility that supports multicast group management.
ANSI	American National Standards Institute; the governing body for fibre channel standards in the U.S.A.
API	Application Programming Interface; defined protocol that allows applications to interface with a set of services.
Arbitrated Loop	A shared 100 MBps fibre channel transport structured as a loop. Can support up to 126 devices and one fabric attachment. See also *Topology*.
ASIC	Application Specific Integrated Circuit.
ATM	Asynchronous Transfer Mode; a transport used for transmitting data over LANs or WANs that transmit fixed-length units of data. Provides any-to-any connectivity, and allows nodes to transmit simultaneously.
AW_TOV	Arbitration Wait Time-out Value; the minimum time an arbitrating L_Port waits for a response before beginning loop initialization.
Bandwidth	The total transmission capacity of a cable, link, or system. Usually measured in bps (bits per second). May also refer to the range of transmission frequencies available to a network. See also *Throughput*.
BB_Credit	Buffer-to-buffer credit; the number of frames that can be transmitted to a directly connected recipient or within an arbitrated loop. Determined by the number of receive buffers available. See also *Buffer-to-buffer Flow Control*, *EE_Credit*.
Beginning Running Disparity	The disparity at the transmitter or receiver when the special character associated with an ordered set is encoded or decoded. See also *Disparity*.
BER	Bit Error Rate; the rate at which bits are expected to be received in error. Expressed as the ratio of error bits to total bits transmitted. See also *Error*.
Block	As applies to fibre channel, upper-level application data that is transferred in a single sequence.

Broadcast	The transmission of data from a single source to all devices in the fabric, regardless of zoning. See also *Multicast*, *Unicast*.
Brocade® Distributed Fabrics	The combined manual for the software products Brocade Extended Fabrics and Brocade Remote Switch ("Distributed Fabrics" is not a software product). See also *Brocade Extended Fabrics*, *Brocade Remote Switch*.
Brocade Extended Fabrics™	A Brocade product that runs on Fabric OS and allows creation of a fibre channel fabric interconnected over distances of up to 100 kilometers. See also *Brocade Distributed Fabrics*.
Brocade Fabric Access™	A Brocade product that consists of a set of APIs that allow third party applications to interface with Fabric OS.
Brocade Fabric Assist™	A Brocade feature that enables private and public hosts to access public targets anywhere on the fabric, provided they are in the same Fabric Assist zone. This feature is available only when both Brocade QuickLoop and Brocade Zoning are installed on the switch.
Brocade Fabric Manager™	A Brocade product that works in conjunction with Web Tools to provide a graphical user interface for managing switch groups (such as the SilkWorm 6400) as a single unit, instead of as separate switches. Fabric Manager is installed on and run from a computer workstation.
Brocade Fabric Watch™	A Brocade product that runs on Fabric OS and allows monitoring and configuration of fabric and switch elements.
Brocade ISL Trunking™	A Brocade feature that enables distribution of traffic over the combined bandwidth of up to four ISLs (between adjacent switches), while preserving in-order delivery. A set of trunked ISLs is called a trunking group; each port employed in a trunking group is called a trunking port. See also *Master Port*.
Brocade Performance Monitoring™	A Brocade product that provides error and performance information to the administrator and end user for use in storage management.
Brocade QuickLoop™	A Brocade product that makes it possible to allow private devices within loops to communicate with public and private devices across the fabric through the creation of a larger loop. May also refer to the arbitrated loop created using this software. A QuickLoop can contain a number of devices or looplets; all devices in the same QuickLoop share a single AL_PA space.
Brocade Remote Switch™	A Brocade product that runs on Fabric OS and enables two SilkWorm 2000 fabric switches to be connected over an ATM (asynchronous transfer mode) connection. This requires a compatible fibre channel to ATM gateway, and can have a distance of up to 10 kilometers between each switch and the respective ATM gateway. See also *Brocade Distributed Fabrics*.
Brocade SES™	A Brocade product that runs on Fabric OS and allows monitoring, configuring, and maintenance of the Brocade SilkWorm Switch family using SCSI-3 Enclosure Services.
Brocade Web Tools™	A Brocade product that runs on Fabric OS and provides a graphical interface to allow monitoring and management of individual switches or entire fabrics from a standard workstation.

Brocade Zoning™	A Brocade product that runs on Fabric OS and allows partitioning of the fabric into logical groupings of devices. Devices in a zone can only access and be accessed by devices in the same zone. See also *Zone*.
Buffer-to-buffer Flow Control	Management of the frame transmission rate in either a point-to-point topology or in an arbitrated loop. See also *BB_Credit*.
Cascade	Two or more interconnected fibre channel switches. SilkWorm 2000 switches can be cascaded up to 239 switches, with a recommended maximum of seven interswitch links (no path longer than eight switches). See also *Fabric*, *ISL*.
Chassis	The metal frame in which the switch and switch components are mounted.
Circuit	An established communication path between two ports. Consists of two virtual circuits capable of transmitting in opposite directions. See also *Link*.
Class 1	Service that provides a dedicated connection between two ports (also called connection-oriented service), with notification of delivery or nondelivery.
Class 2	Service that provides multiplex and connectionless frame switching service between two ports, with notification of delivery or nondelivery.
Class 3	Service that provides a connectionless frame switching service between two ports, without notification of delivery or nondelivery of data. Can also be used to provide a multicast connection between the originator and recipients, with notification of delivery or nondelivery.
Class F	Connectionless service for control traffic between switches, with notification of delivery or nondelivery of data between the E_Ports.
Class of Service	A specified set of delivery characteristics and attributes for frame delivery.
Comma	A unique pattern (either 1100000 or 0011111) used in 8B/10B encoding to specify character alignment within a data stream. See also *K28.5*.
Community (SNMP)	A relationship between a group of SNMP managers and an SNMP agent, in which authentication, access control, and proxy characteristics are defined. See also *SNMP*.
CRC	Cyclic Redundancy Check; a check for transmission errors included in every data frame.
Credit	As applies to fibre channel, the number of receive buffers available for transmission of frames between ports. See also *BB_Credit*, *EE_Credit*.
Cut-through	A switching technique that allows the route for a frame to be selected as soon as the destination address is received. See also *Route*.
Data Word	Type of transmission word that occurs within frames. The frame header, data field, and CRC all consist of data words. See also *Frame*, *Ordered set*, *Transmission Word*.
Defined Zone Configuration	The set of all zone objects defined in the fabric. May include multiple zone configurations. See also *Enabled Configuration*, *Zone Configuration*.
Disparity	The relationship of ones and zeros in an encoded character. "Neutral disparity" means an equal number of each, "positive disparity" means a majority of ones, and "negative disparity" means a majority of zeros.
DLS	Dynamic Load Sharing; dynamic distribution of traffic over available paths. Allows for recomputing of routes when an Fx_Port or E_Port changes status.

Domain ID	As applies to SilkWorm switches, a unique number between 1 and 239 that identifies the switch to the fabric and is used in routing frames. Usually automatically assigned by the switch, but can be manually assigned.
E_D_TOV	Error Detect Time-out Value; the minimum amount of time a target waits for a sequence to complete before initiating recovery. Can also be defined as the maximum time allowed for a round-trip transmission before an error condition is declared. See also *R_A_TOV*, *RR_TOV*.
E_Port	Expansion Port; a type of switch port that can be connected to an E_Port on another switch to create an ISL. See also *ISL*.
EE_Credit	End-to-end Credit; the number of receive buffers allocated by a recipient port to an originating port. Used by Class 1 and 2 services to manage the exchange of frames across the fabric between source and destination. See also *End-to-end Flow Control*, *BB_Credit*.
EIA Rack	A storage rack that meets the standards set by the Electronics Industry Association.
Enabled Zone Configuration	The currently enabled configuration of zones. Only one configuration can be enabled at a time. See also *Defined Configuration*, *Zone Configuration*.
End-to-end Flow Control	Governs flow of class 1 and 2 frames between N_Ports. See also *EE_Credit*.
Error	As applies to fibre channel, a missing or corrupted frame, time-out, loss of synchronization, or loss of signal (link errors). See also *Loop Failure*.
Exchange	The highest level fibre channel mechanism used for communication between N_Ports. Composed of one or more related sequences, and can work in either one or both directions.
F_Port	Fabric Port; a port that is able to transmit under fabric protocol and interface over links. Can be used to connect an N_Port to a switch. See also *FL_Port*, *Fx_Port*.
Fabric	A fibre channel network containing two or more switches in addition to hosts and devices. May also be referred to as a switched fabric. See also *Topology*, *SAN*, *Cascade*.
Fabric Name	The unique identifier assigned to a fabric and communicated during login and port discovery.
Fabric OS™	The proprietary operating system on Brocade switches.
FC-AL-3	The Fibre Channel Arbitrated Loop standard defined by ANSI. Defined on top of the FC-PH standards.
FC-FLA	The Fibre Channel Fabric Loop Attach standard defined by ANSI.
FCP	Fibre Channel Protocol; mapping of protocols onto the fibre channel standard protocols. For example, SCSI FCP maps SCSI-3 onto fibre channel.
FC-PH-1, 2, 3	The Fibre Channel Physical and Signalling Interface standards defined by ANSI.
FC-PI	The Fibre Channel Physical Interface standard defined by ANSI.
FC-PLDA	The Fibre Channel Private Loop Direct Attach standard defined by ANSI. Applies to the operation of peripheral devices on a private loop.

FC-SW-2	The second generation of the Fibre Channel Switch Fabric standard defined by ANSI. Specifies tools and algorithms for the interconnection and initialization of fibre channel switches in order to create a multi-switch fibre channel fabric.
Fibre Channel Transport	A protocol service that supports communication between fibre channel service providers. See also *FSP*.
Fill Word	An IDLE or ARB ordered set that is transmitted during breaks between data frames to keep the fibre channel link active.
Firmware	The basic operating system provided with the hardware.
FL_Port	Fabric Loop Port; a port that is able to transmit under fabric protocol and also has arbitrated loop capabilities. Can be used to connect an NL_Port to a switch. See also *F_Port*, *Fx_Port*.
FLOGI	Fabric Login; the process by which an N_Port determines whether a fabric is present, and if so, exchanges service parameters with it. See also *PLOGI*.
Frame	The fibre channel structure used to transmit data between ports. Consists of a start-of-frame delimiter, header, any optional headers, the data payload, a cyclic redundancy check (CRC), and an end-of-frame delimiter. There are two types of frames: Link control frames (transmission acknowledgements, etc.) and data frames.
FRU	Field-replaceable Unit; a component that can be replaced on site.
FS	Fibre Channel Service; a service that is defined by fibre channel standards and exists at a well-known address. For example, the Simple Name Server is a fibre channel service. See also *FSP*.
FSP	Fibre Channel Service Protocol; the common protocol for all fabric services, transparent to the fabric type or topology. See also *FS*.
FSPF	Fabric Shortest Path First; Brocade's routing protocol for fibre channel switches.
Full-duplex	A mode of communication that allows the same port to simultaneously transmit and receive frames. See also *Half-duplex*.
Fx_Port	A fabric port that can operate as either an F_Port or FL_Port. See also *F_Port*, *FL_Port*.
G_Port	Generic Port; a port that can operate as either an E_Port or F_Port. A port is defined as a G_Port when it is not yet connected or has not yet assumed a specific function in the fabric.
GBIC	Gigabit Interface Converter; a removable serial transceiver module that allows gigabaud physical-level transport for fibre channel and gigabit ethernet.
Gbps	Gigabits per second (1,062,500,000 bits/second).
GBps	GigaBytes per second (1,062,500,000 bytes/second).
Half-duplex	A mode of communication that allows a port to either transmit or receive frames at any time, but not simultaneously (with the exception of link control frames, which can be transmitted at any time). See also *Full-duplex*.
Hard Address	The AL_PA that an NL_Port attempts to acquire during loop initialization.
HBA	Host Bus Adapter; the interface card between a server or workstation bus and the fibre channel network.

Hub	A fibre channel wiring concentrator that collapses a loop topology into a physical star topology. Nodes are automatically added to the loop when active and removed when inactive.
Idle	Continuous transmission of an ordered set over a fibre channel link when no data is being transmitted, to keep the link active and maintain bit, byte, and word synchronization.
Initiator	A server or workstation on a fibre channel network that initiates communications with storage devices. See also *Target*.
Integrated Fabric	The fabric created by a SilkWorm 6400, consisting of six SilkWorm 2250 switches cabled together and configured to handle traffic as a seamless group.
IOD	In-order Delivery; a parameter that, when set, guarantees that frames are either delivered in order or dropped.
ISL	Interswitch Link; a fibre channel link from the E_Port of one switch to the E_Port of another. See also *E_Port*, *Cascade*.
Isolated E_Port	An E_Port that is online but not operational due to overlapping domain IDs or nonidentical parameters (such as E_D_TOVs). See also *E_Port*.
IU	Information Unit; a set of information as defined by either upper-level process protocol definition or upper-level protocol mapping.
JBOD	Just a Bunch Of Disks; indicates a number of disks connected in a single chassis to one or more controllers. See also *RAID*.
K28.5	A special 10-bit character used to indicate the beginning of a transmission word that performs fibre channel control and signaling functions. The first seven bits of the character are the comma pattern. See also *Comma*.
L_Port	Loop Port; a node port (NL_Port) or fabric port (FL_Port) that has arbitrated loop capabilities. An L_Port can be in one of two modes: • *Fabric mode* Connected to a port that is not loop capable, and using fabric protocol. • *Loop mode* In an arbitrated loop and using loop protocol. An L_Port in loop mode can also be in participating mode or non-participating mode. See also *Non-participating Mode*, *Participating Mode*.
Latency	The period of time required to transmit a frame, from the time it is sent until it arrives.
Link	As applies to fibre channel, a physical connection between two ports, consisting of both transmit and receive fibres. See also *Circuit*.
Link Services	A protocol for link-related actions.
LIP	Loop Initialization Primitive; the signal used to begin initialization in a loop. Indicates either loop failure or resetting of a node.
LM_TOV	Loop Master Time-out Value; the minimum time that the loop master waits for a loop initialization sequence to return.
Loop Failure	Loss of signal within a loop for any period of time, or loss of synchronization for longer than the time-out value.
Loop Initialization	The logical procedure used by an L_Port to discover its environment. Can be used to assign AL_PA addresses, detect loop failure, or reset a node.

Loop_ID	A hex value representing one of the 127 possible AL_PA values in an arbitrated loop.
Looplet	A set of devices connected in a loop to a port that is a member of another loop.
LPSM	Loop Port State Machine; the logical entity that performs arbitrated loop protocols and defines the behavior of L_Ports when they require access to an arbitrated loop.
LWL	Long Wavelength; a type of fiber optic cabling that is based on 1300mm lasers and supports link speeds of 1.0625 Gbps. May also refer to the type of GBIC or SFP. See also *SWL*.
Master Port	As relates to trunking, the port that determines the routing paths for all traffic flowing through the trunking group. One of the ports in the first ISL in the trunking group is designated as the master port for that group. See also *Brocade ISL Trunking*.
MIB	Management Information Base; an SNMP structure to help with device management, providing configuration and device information.
Multicast	The transmission of data from a single source to multiple specified N_Ports (as opposed to all the ports on the network). See also *Broadcast*, *Unicast*.
Multimode	A fiber optic cabling specification that allows up to 500 meters between devices.
N_Port	Node Port; a port on a node that can connect to a fibre channel port or to another N_Port in a point-to-point connection. See also *NL_Port*, *Nx_Port*.
Name Server	Frequently used to indicate Simple Name Server. See also *SNS*.
NL_Port	Node Loop Port; a node port that has arbitrated loop capabilities. Used to connect an equipment port to the fabric in a loop configuration through an FL_Port. See also *N_Port*, *Nx_Port*.
Node	A fibre channel device that contains an N_Port or NL_Port.
Node Name	The unique identifier for a node, communicated during login and port discovery.
Non-participating Mode	A mode in which an L_Port in a loop is inactive and cannot arbitrate or send frames, but can retransmit any received transmissions. This mode is entered if there are more than 127 devices in a loop and an AL_PA cannot be acquired. See also *L_Port*, *Participating Mode*.
Nx_Port	A node port that can operate as either an N_Port or NL_Port.
Ordered Set	A transmission word that uses 8B/10B mapping and begins with the K28.5 character. Ordered sets occur outside of frames, and include the following items: • *Frame delimiters* Mark frame boundaries and describe frame contents. • *Primitive signals* Indicate events. • *Primitive sequences* Indicate or initiate port states. Ordered sets are used to differentiate fibre channel control information from data frames and to manage the transport of frames.
Packet	A set of information transmitted across a network. See also *Frame*.
Participating Mode	A mode in which an L_Port in a loop has a valid AL_PA and can arbitrate, send frames, and retransmit received transmissions. See also *L_Port*, *Non-participating Mode*.

Path Selection	The selection of a transmission path through the fabric. Brocade switches use the FSPF protocol.
Phantom Address	An AL_PA value that is assigned to an device that is not physically in the loop. Also known as phantom AL_PA.
Phantom Device	A device that is not physically in an arbitrated loop but is logically included through the use of a phantom address.
PLOGI	Port Login; the port-to-port login process by which initiators establish sessions with targets. See also *FLOGI*.
Point-to-point	A fibre channel topology that employs direct links between each pair of communicating entities. See also *Topology*.
Port_Name	The unique identifier assigned to a fibre channel port. Communicated during login and port discovery.
POST	Power On Self-Test; a series of tests run by a switch after it is turned on.
Private NL_Port	An NL_Port that communicates only with other private NL_Ports in the same loop and does not log into the fabric.
Private Device	A device that supports arbitrated loop protocol and can interpret 8-bit addresses, but cannot log into the fabric.
Private Loop	An arbitrated loop that does not include a participating FL_Port.
Protocol	A defined method and a set of standards for communication.
Public NL_Port	An NL_Port that logs into the fabric, can function within either a public or a private loop, and can communicate with either private or public NL_Ports.
Public Device	A device that supports arbitrated loop protocol, can interpret 8-bit addresses, and can log into the fabric.
Public Loop	An arbitrated loop that includes a participating FL_Port, and may contain both public and private NL_Ports.
R_A_TOV	Resource Allocation Time-out Value; the maximum time a frame can be delayed in the fabric and still be delivered. See also *E_D_TOV*, *RR_TOV*.
RAID	Redundant Array of Independent Disks; a collection of disk drives that appear as a single volume to the server and are fault tolerant through mirroring or parity checking. See also *JBOD*.
Request Rate	The rate at which requests arrive at a servicing entity. See also *Service Rate*.
Route	As applies to a fabric, the communication path between two switches. May also apply to the specific path taken by an individual frame, from source to destination. See also *FSPF*.
Routing	The assignment of frames to specific switch ports, according to frame destination.
RR_TOV	Resource Recovery Time-out Value; the minimum time a target device in a loop waits after a LIP before logging out a SCSI initiator. See also *E_D_TOV*, *R_A_TOV*.
RSCN	Registered State Change Notification; a switch function that allows notification of fabric changes to be sent from the switch to specified nodes.
SAN	Storage Area Network; a network of systems and storage devices that communicate using fibre channel protocols. See also *Fabric*.

Sequence	A group of related frames transmitted in the same direction between two N_Ports.
Service Rate	The rate at which an entity can service requests. See also *Request Rate*.
SFP	Small Form Factor Pluggable; optical transceiver used to convert signals between optical fiber cables and switches.
SI	Sequence Initiative.
SilkWorm	The brand name for Brocade's family of switches
Single Mode	The fiber optic cabling standard that corresponds to distances of up to 10 km between devices.
SNMP	Simple Network Management Protocol. An internet management protocol that uses either IP for network-level functions and UDP for transport-level functions, or TCP/IP for both. Can be made available over other protocols, such as UDP/IP, because it does not rely on the underlying communication protocols. See also *Community (SNMP)*.
SNS	Simple Name Server; a switch service that stores names, addresses, and attributes for up to 15 minutes, and provides them as required to other devices in the fabric. SNS is defined by fibre channel standards and exists at a well-known address. May also be referred to as directory service. See also *FS*.
Switch	Hardware that routes frames according to fibre channel protocol and is controlled by software.
Switch Name	The arbitrary name assigned to a switch.
Switch Port	A port on a switch. Switch ports can be E_Ports, F_Ports, or FL_Ports.
SWL	Short Wavelength; a type of fiber optic cabling that is based on 850mm lasers and supports 1.0625 Gbps link speeds. May also refer to the type of GBIC or SFP. See also *LWL*.
Target	A storage device on a fibre channel network. See also *Initiator*.
Tenancy	The time from when a port wins arbitration in a loop until the same port returns to the monitoring state. Also referred to as loop tenancy.
Throughput	The rate of data flow achieved within a cable, link, or system. Usually measured in bps (bits per second). See also *Bandwidth*.
Topology	As applies to fibre channel, the configuration of the fibre channel network and the resulting communication paths allowed. There are three possible topologies: • Point to point - A direct link between two communication ports. • Switched fabric - Multiple N_Ports linked to a switch by F_Ports. • Arbitrated loop - Multiple NL_Ports connected in a loop.
Translative Mode	A mode in which private devices can communicate with public devices across the fabric.
Transmission Character	A 10-bit character encoded according to the rules of the 8B/10B algorithm.
Transmission Word	A group of four transmission characters.
Trap (SNMP)	The message sent by an SNMP agent to inform the SNMP management station of a critical error. See also *SNMP*.

Tunneling	A technique for enabling two networks to communicate when the source and destination hosts are both on the same type of network, but are connected by a different type of network.
U_Port	Universal Port; a switch port that can operate as a G_Port, E_Port, F_Port, or FL_Port. A port is defined as a U_Port when it is not connected or has not yet assumed a specific function in the fabric.
UDP	User Datagram Protocol; a protocol that runs on top of IP and provides port multiplexing for upper-level protocols.
ULP	Upper-level Protocol; the protocol that runs on top of fibre channel. Typical upper-level protocols are SCSI, IP, HIPPI, and IPI.
ULP_TOV	Upper-level Time-out Value; the minimum time that a SCSI ULP process waits for SCSI status before initiating ULP recovery.
Unicast	The transmission of data from a single source to a single destination. See also *Broadcast*, *Multicast*.
Well-known Address	As pertaining to fibre channel, a logical address defined by the fibre channel standards as assigned to a specific function, and stored on the switch.
Workstation	A computer used to access and manage the fabric. May also be referred to as a management station or host.
WWN	Worldwide Name; an identifier that is unique worldwide. Each entity in a fabric has a separate WWN.
Zone	A set of devices and hosts attached to the same fabric and configured as being in the same zone. See also *Brocade Zoning*. Devices and hosts within the same zone have access permission to others in the zone, but are not visible to any outside the zone.
Zone Configuration	A specified set of zones. Enabling a configuration enables all zones in that configuration. See also *Defined Configuration*, *Enabled Configuration*.

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